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SPECIFICATION FOR LACTOMETERS

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SPECIFICATION FOR LACTOMETERS

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Indian Standard

SPECIFICATION FOR LACTOMETERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 10 September 1980, after the draft finalized by the Dairy Products Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 'Indian Standard Specification for density hydrometers for use in milk' (IS : 1183-1957) was published in 1957 and subsequently revised in 1965 incorporating the improved techniques with method of calibration. Keeping in view the non-availability of properly calibrated hydrometers and the preference of users to use specific gravity lactometers only, as was revealed through data collected from the various dairies in the country, the Committee decided that two separate standards should be prepared — one covering lactometers only and the other covering the method for determination of solids-not-fat in milk by the use of lactometer. IS : 1183-1965* would be withdrawn on publication of these standards.

0.3 This standard covers specification and calibration of specific gravity lactomets. The other standard when published would cover the method for determination of solids-not-fat in milk by the use of specific gravity lactometer.

0.3.1 The lactometers specified in the standard are calibrated at 27°C which was desirable on account of the tropical conditions prevailing in the country. Taking into consideration the fact that the fat content of milk obtained in India varies considerably as compared to other countries and because of the existence in India of milk obtained both from buffaloes and cows with varying fat content, the Committee decided that the specific gravity lactometer should be calibrated with a liquid having a surface tension of 50 mN/m by the Drop Method.

0.4 In the formulation of this standard, considerable assistance has been derived from the valuable information received from the National Dairy Research Institute, Karnal.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with

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*Specification for density hydrometers for use in milk (*revised*).

IS : 2-1960*. The number of significant places retained in the rounded off values should be the same as that of the specified values in this standard.

1. SCOPE

1.1 This standard specifies the requirements of lactometers for determining the specific gravity of whole milk and skim milk, over a range of 1·020 to 1·035 when read in a liquid medium having a temperature of 27°C, and a surface tension of 50 mN/m (*see* Note), the reading being taken at the top of the meniscus.

NOTE — The average surface tension, at 27°C, of milk tested in India is found to be about 50 mN/m as determined by Drop Method.

2. SIZE

2.1 The size of the lactometer shall be such that it is capable of being used with about 200 ml of milk.

3. FORM

3.1 The stem and the bulb of each lactometer shall be circular in cross section.

3.2 There shall be no abrupt changes in cross section, which would hinder cleaning and drying or permit air bubbles to be entrapped.

3.3 The bulb of the lactometer shall be of the type shown in Fig. 1, namely, as a glass cylinder terminating at the upper end in approximately a hemisphere and at the lower end in a cone.

4. MATERIAL OF CONSTRUCTION

4.1 The bulb and stem shall be made of clear glass, as far as possible, free from visible defects and shall be well annealed. The glass shall be neutral and have sufficient resisting power against mechanical influences, in particular, against scratches and against corrosion by common chemicals.

4.2 The external surface of the stem shall be finished smooth and free from irregularities.

4.3 The lactometer shall be loaded by means of lead shots, or other suitable loading material embedded in a suitable cementing material, in the base of the bulb. The lead shots, or other suitable loading material,

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*Rules for rounding off numerical values (*revised*).

shall be securely fixed in position so that there is no loose material in the bulb. The cementing material used shall not soften at 80°C.

NOTE — Mercury may be used in place of lead as a loading material but it should be confined in the lower portion of the bulb.

5. WORKMANSHIP

5.1 The bulb shall be so loaded that the lactometer always floats at all points within its range with the stem within 1·5° of the vertical.

5.2 The axis of the stem shall be in line with the axis of the bulb.

5.3 The scale and inscription shall be marked clearly in permanent black ink on high quality non-glazed off-white or orange paper having a smooth surface.

5.4 The paper shall show no sign of charring.

5.5 A thermometer shall not form part of the instrument.

5.6 The surface of the lactometer in contact with the sample when carrying out the test shall not bear any sand-blasted or etched mark.

6. DIMENSIONS

6.1 The lactometers shall conform to the dimensions given in Table 1 and Fig. 1.

7. SCALE

7.1 The lactometer for use in milk shall be adjusted for reading at the top of the meniscus.

7.2 The lactometer shall be deemed as not accurate when the readings at 27°C at the level of the flat surface of a transparent liquid of surface tension 50 mN/m exceed the specific gravity of the liquid by 0·000 5.

7.2.1 The corrections for scale errors of the lactometer shall be determined as given in Appendix A.

7.3 The graduation lines shall be fine black lines of uniform thickness marked on the paper securely fixed inside of the stem. The lines shall show no evident irregularities in spacing. The scale shall be straight and without twist, and the graduation lines shall be at right angles to the axis of the lactometer. The thickness of the graduation lines shall be not less than 0·10 mm and not more than 0·20 mm.

7.4 The shortest graduation line shall be at least 2 mm in length. Every alternate line shall extend beyond the shortest lines.

TABLE 1 DIMENSIONS, DIVISIONS AND TOLERANCES ON LACTOMETERS

(*Clause* 6.1)

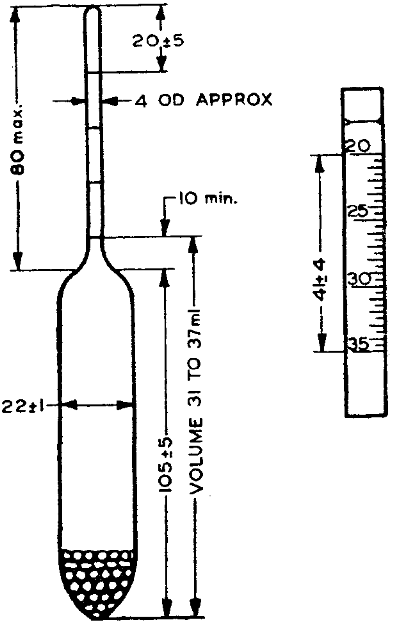
SL No.	CHARACTERISTIC	DIMENSIONS/DIVISIONS/ TOLERANCES
(1)	(2)	(3)
i)	Range covered by scale, specific gravity	1·020 to 1·035
ii)	Specific gravity equivalent for each sub-division	0·000 5
iii)	Permissible error at any point	± 0·000 5
iv)	Number of sub-divisions on scale	30
v)	Number of sub-divisions beyond nominal scale of the top graduation	One or nil
vi)	Length in mm of stem above top graduation mark	20 ± 5
vii)	Scale length in mm	41 ± 4
viii)	Distance in mm below the lowest graduation mark, where the stem has to remain uniform in diameter, *Min*	10
ix)	External diameter in mm of stem containing scale (approx)	4·0
x)	External diameter in mm of bulb	22 ± 1
xi)	Length in mm of uniform stem, *Max*	80
xii)	Volume in ml below bottom graduation line:	
	a) not more than	37
	b) not less than	31
xiii)	Length in mm of the bulb	105 ± 5

7.5 All numbers on the scale shall be in abbreviated form, for example, '30' at the scale reading corresponding to 1·030. Starting from the topmost division every fifth division or tenth sub-division shall be numbered. On all the lactometers the length of the numbered graduation lines shall exceed that of all other graduation lines.

7.6 The longer graduation marks shall extend beyond the shorter ones on the left of the scale only. On the right of the scale, the ends of all graduation marks shall lie vertically above one another.

7.7 The numbers shall be on the left of the scale, immediately above the graduation marks to which they relate and they shall not encroach upon the space occupied by the shortest graduation marks. The numbers shall not touch or intersect any graduation mark.

7.7.1 Recommended method of numbering is illustrated in Fig. 1.



All dimensions in millimetres.

FIG. 1 LACTOMETER FOR USE IN MILK

8. REFERENCE MARK

8.1 A reference mark consisting of a short horizontal straight line with a 'V' at each end, like >—< shall be marked on the paper scale a few millimetres above the topmost graduation mark. A fine, clearly etched, permanent line of uniform thickness shall be etched on the stem of the lactometer coincident with the horizontal portion of the reference mark and slightly longer than that portion of the reference mark, so that the ends of the etched line project into the V's at the ends of the reference mark.

9. INSCRIPTIONS

9.1 The lactometer shall have permanently and legibly marked on the paper bearing the scale, or on a label fixed inside the bulb:

a) The basis of the scale, namely, specific gravity at 27°C;
b) The inscription '50 mN/m';
c) Manufacturer's name, or recognized trade-mark; and
d) Identification number.

9.1.1 When the inscriptions are marked on the paper bearing the scale, they shall not encroach upon the space occupied by the scale and shall not intersect any of the graduation marks on numbers.

9.1.2 The lactometer may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

10. CHECKING

10.1 Every lactometer before being put into service shall be tested to check the accuracy of its scale. It shall be examined from time to time to see that there has been no displacement of the paper scale during use. Any displacement may be detected by lack of coincidence between the horizontal line etched on the stem and the datum line marked on the paper scale like > — <.

NOTE — For many purposes, it is sufficient to know that the scale errors do not exceed the maximum errors permitted under the specification. Where great accuracy is required, the scale errors should be known and allowed for.

10.2 The indication of the lactometer at the level of flat surface in a liquid (sodium carbonate solution prepared as described in Appendix A), after correction for the height of the meniscus (**7.2**) shall not differ by specific gravity ± 0·0005 from the value of the liquid obtained by gravimetric method using density bottle or pyknometer. Or, when a lactometer is compared with a certified lactometer in accordance with the method described in Appendix A, its indication shall not vary more than ± 0·0005 from the indication of the certified lactometer (duly corrected for its scale error).

11. LACTOMETER JARS

11.1 The lactometer for use in milk shall be used in cylindrical vessels made of glass or metal having the top finished off square and without a spout, and having the internal diameter of 32 ± 2 mm and internal depth of 185 ± 5 mm.

11.2 The cylindrical vessel shall stand vertically and firmly on its base on a horizontal surface.

12. THERMOMETER

12.1 A thermometer having the following characteristics is suitable:

a) Overall length	255 ± 10 mm
b) Scale length	105 ± 10 mm
c) Distance between lowest graduation line and bottom bulb	110 ± 5 mm
d) Scale range	10 to 45°C
e) Graduation interval	0·5°C
f) Scale accuracy	± 0·2°C

APPENDIX A

(*Clauses* 7.2.1 *and* 10.2)

DETERMINATION OF CORRECTIONS FOR SCALE ERRORS OF THE LACTOMETERS

A-1. GENERAL

A-1.1 It is necessary to determine corrections for scale errors of the lactometers to ensure that the correction at any point on the scale does not exceed the maximum permitted (**7.2**) and to be able to correct observed lactometer readings. For this, the readings taken at temperatures other than 27°C should first be converted to reading at 27°C. Although the lactometers are calibrated to be read at the top of the milk meniscus, for checking their accuracy the reference datum for reading is the level of the flat liquid surface because this is more precise. When using this datum line, allowance should, therefore, be made for the height of the meniscus, which in a liquid with a temperature of 27°C and a surface tension of 50 mN/m (Drop Method) has been found to be equivalent to 0·000 5 specific gravity (one sub-division).

A-1.2 As it is not feasible to determine the correction, for scale errors at every graduation mark, it is recommended that the lactometer error should be checked by the procedure given in **A-2** at three points on their scale against a lactometer of the same type, that is, of the same number, which has been certified by a competent laboratory.

A-2. METHOD

A-2.1 Prepare liquids with a surface tension of about 50 mN/m (Drop method and specific gravity approximately 1·025, 1·030 and 1·034 at about 27°C). Such liquids are conveniently prepared by dissolving the appropriate mass of anhydrous sodium carbonate given below in 300 ml of distilled water:

Specific Gravity at 27°C	*Mass of Anhydrous Sodium Carbonate* g
1·019	15·3
1·025	19·2
1·030	21·6
1·034	24·0

A-2.1.1 Add 50 ml industrial methylated spirit (92 percent, ethanol) to the solution so obtained and make up to a total volume of 500 ml with distilled water.

A-2.2 Float the certified lactometer and the lactometer to be checked side by side in a rectangular plate glass tank containing one of the liquids. Observe their simultaneous readings at the level of the flat liquid surface which shall be 2 to 3 cm below the top of the tank. Repeat this procedure with the two other liquids. The liquids should be well stirred before inserting the lactometers. The lactometers should attain the same temperature as the liquids but the temperature of each liquid need not be exactly 27°C.

A-2.3 Designate the correction with a positive sign (+) when the correction has to be added to the reading, and with a minus sign (—) when the correction has to be subtracted from the reading to obtain the actual value at 27°C.

(*Continued from page* 2)

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